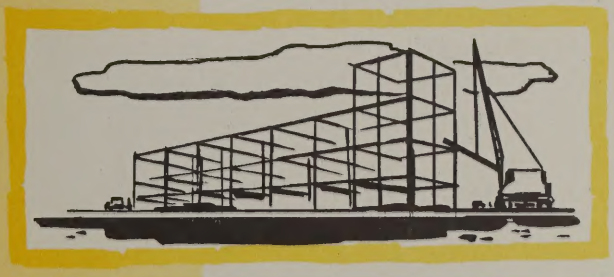
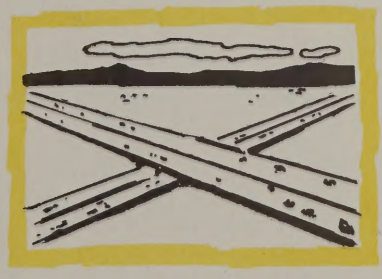
Wm. P. Hofmann

STATE OF NEW YORK
DEPT. OF PUBLIC WORKS

CONSOLIDATION TEST





bureau of electronic data processing

ENGINEERING DATA PROCESSING SERIES

APRIL - 1964

STATE OF NEW YORK

DEPARTMENT OF PUBLIC WORKS

CONSOLIDATION TEST

PROGRAM NUMBER 5502

Joseph P. Ronan
Administrative Deputy

J. Burch McMorran
Superintendent

April 1964

BUREAU OF ELECTRONIC DATA PROCESSING

Consolidation Test

Program Number 5502

ACKNOWLEDGEMENTS

This project was progressed jointly by the Bureau of Electronic Data Processing and the Bureau of Soil Mechanics.

Programming and documentation were accomplished by Henry Rivet, Computer Programmer (Scientific) (Electronic Data Processing). Program analysis was accomplished by Everett C. Hall, Assistant Soils Engineer (Bureau of Soil Mechanics).

Charles E. Carlson, Director
Bureau of Electronic Data Processing

William P. Hofmann, Director
Bureau of Soil Mechanics

NYSDOT
Library
50 Wolf Road, POD 34
Albany, New York 12232

Consolidation Test

Program Number 5502

Table of Contents

	Page
General Manual	
Introduction	A 1
Analysis	A 3
Preparation and Submission of Data (Sample Job Transmittal Form)	A 9
5502-1	
Symbol List	A 11
Formulae	A 13
Sample Input	A 14
Block Diagram	A 15
FORTRAN Listing	A 17
Sample Output	A 18
5502-2	
Symbol List	A 19
Sample Input	A 20
Block Diagram	A 21
FORTRAN Listing	A 25
Sample Output	A 29
Operator's Manual	
5502-1	
Computer Operating Instructions	B 1
Job Instructions	B 3
Application Flow Chart	B 5
Sample Output	B 6
5502-2	
Computer Operating Instructions	B 7
Job Instructions	B 10
Application Flow Chart	B 11
Sample Output	B 12
Keypunch Manual	
5502-1	
Card Punching Instructions	C 1
Source Document	C 2
Card Layout	C 3
5502-2	
Card Punching Instructions	C 5
Source Document	C 6
Card Layout	C 7

Consolidation Test

Program Number 5502

General

A. Part I

This 1620 FORTRAN program computes values for HEIGHT OF SOLID, MOISTURE CONTENT, WET DENSITY and SATURATION obtained from soil samples, and, VOID RATIO and square of the AVERAGE SAMPLE HEIGHT of the samples under varying pressures. Output is listed such that values for T50 and T90 Coefficients of Permeability and Slope of Secondary Consolidation may be hand-entered from plots computed by program 5505-2.

Input data will be obtained from source documents in accordance with the keypunched section of this manual and punched on cards. Output will be printed on 8½ inch, 2-part continuous forms. Tests may be identified by sample number printed on each page thereof.

Since it is anticipated that these tests will be batched for submission to EDP, the program has been designed to accommodate batch processing. It is also written to compute output for any number of load values.

The object program was compiled with a PDQ FORTRAN processor in fixed format and may be run on any computer of 20K or larger.

B. Part II

Part II of 5502 is processed on a 1620 Computer and Calcomp Digital Incremental Plotter. This run of the program plots two sets of graphs from which coefficients of permeability and slopes of secondary consolidation are determined. The plots consist of log time against dial deflection to find the T50 value, and square root of time against deflection to find the T90 value. The plot routine is programmed to define three graphs of 10 inch height across the chart paper. Dial readings are scaled for 100, 200, 500 or 1000 increments per inch depending upon total dial deflection range. This scaling limits plot range from a minimum of 4 inches to a maximum of 8 inches. Overflow tests have been devised to maintain all plots within $9\frac{1}{2}$ inches of the origin and to prevent loss of the origin because of machine overflow.

Input data for this run is taken from source documents in accordance with the keypunch section of this manual and punched on cards. Output will originate from the Calcomp Plotter and will be executed on 2 inch per cycle semi-log paper and standard one inch cross-section paper. Because of non-availability of required semi-log graph paper at this time, output will be processed on cross-section paper (translucent) and read with a semi-log overlay on a light table.

Input for this run of the program may be batch processed as described in the keypunch and computer operating instructions section of the manual.

CONSOLIDATION TEST

PROGRAM NO. 5502

ANALYSIS

Scope

The objectives of this program are first and foremost to eliminate the time spent in manually calculating and plotting the data from consolidation tests.

Accuracy of results is maintained and since the plotter produces co-ordinates based on .01 inch increments, the accuracy could conceivably be more consistent on the time-compression plots.

Flexibility of test procedures is another feature of this program. While our present rapid loading procedure of three hours duration per load is applicable to the bulk of our consolidation testing, shorter durations for very rapid draining soils are handled by this program and the few additional points necessary to define the secondary slope on a very slow draining soil may be entered manually on the plots. Sizes other than our standard 2.5-inch diameter and 3/4-inch height specimen rings may be used with this program.

The description of the equipment and procedure are not detailed since they presuppose a knowledge of soils and soil testing and are only to show their adaptation to a computer program.

Equipment

Consolidation test frames used are lever type "Soil Test" Models C-280 and C-240 capable of applying maximum pressures of 48,000 and 96,000 pounds per square inch on a 2.5 diameter specimen, respectively.

Federal dial indicators with a total range of 0.5 inches and .0001 inch graduations are used to measure deflections.

The standard specimen ring is 2.5 inches diameter and 0.75 inches in height. This ring is used for trimming the soil specimen and is tapered to fit into the consolidometer barrel, thereby eliminating the need for transferring the specimen from cutting ring to consolidometer.

Procedure

The sample is prepared and set up in the testing apparatus according to accepted consolidation test procedures and the initial data consisting of wet weights, tare weights, height, area of specimen, etc., are entered on Form SM 291-6/64, Page A 14.

The loading schedule commences with 125 pounds per square foot and is doubled in magnitude until the desired maximum load is reached.

The load number, the corresponding magnitude and final dial reading are also entered on SM 291-6/64.

Procedure Cont'd

Deflection readings versus time are recorded on Form SM 290-6/64 (Page A 20) at the indicated time increments.

Duration of each load is established by the following criteria:

Silts and clayey silts of low plasticity are loaded for one hour. Silty clays and clays of medium to high plasticity and most organic soils are loaded for three hours.

Gelatinous organic soils and very plastic clays may require loading durations up to 24 hours. The three-hour duration suffices for the majority of soils tested.

The output data received from the Bureau of Electronic Data Processing consists of a continuous strip chart on which the co-ordinates for dial reading versus log of time and dial reading versus square root of time are plotted. Sample plots are shown on Pages A 28 and A 29. Additional points beyond the three-hour program limit are manually entered when needed.

The individual plots are identified by a printed code number which represents the load number and an assigned test number.

Procedure (Cont'd)

A curve through the co-ordinates is manually constructed and the log fitting and square root fitting method are used to determine the times of 50% and 90% consolidation, respectively. The log slope of secondary consolidation is also determined from the log of time versus dial reading plot (Page A 29).

The moisture content, wet unit weight, degree of saturation, void ratios and average heights squared are received in tabular form (Page A 18) and are used to compute the coefficients of consolidation and construct the void ratio versus log of pressure plots (Page A 8).

Conclusion

The I.B.M. 1620 computer program for processing consolidation data and plotting time-compression curves coupled with the rapid loading method accomplishes its objective of greatly reducing the total time necessary to produce a completed consolidation test.

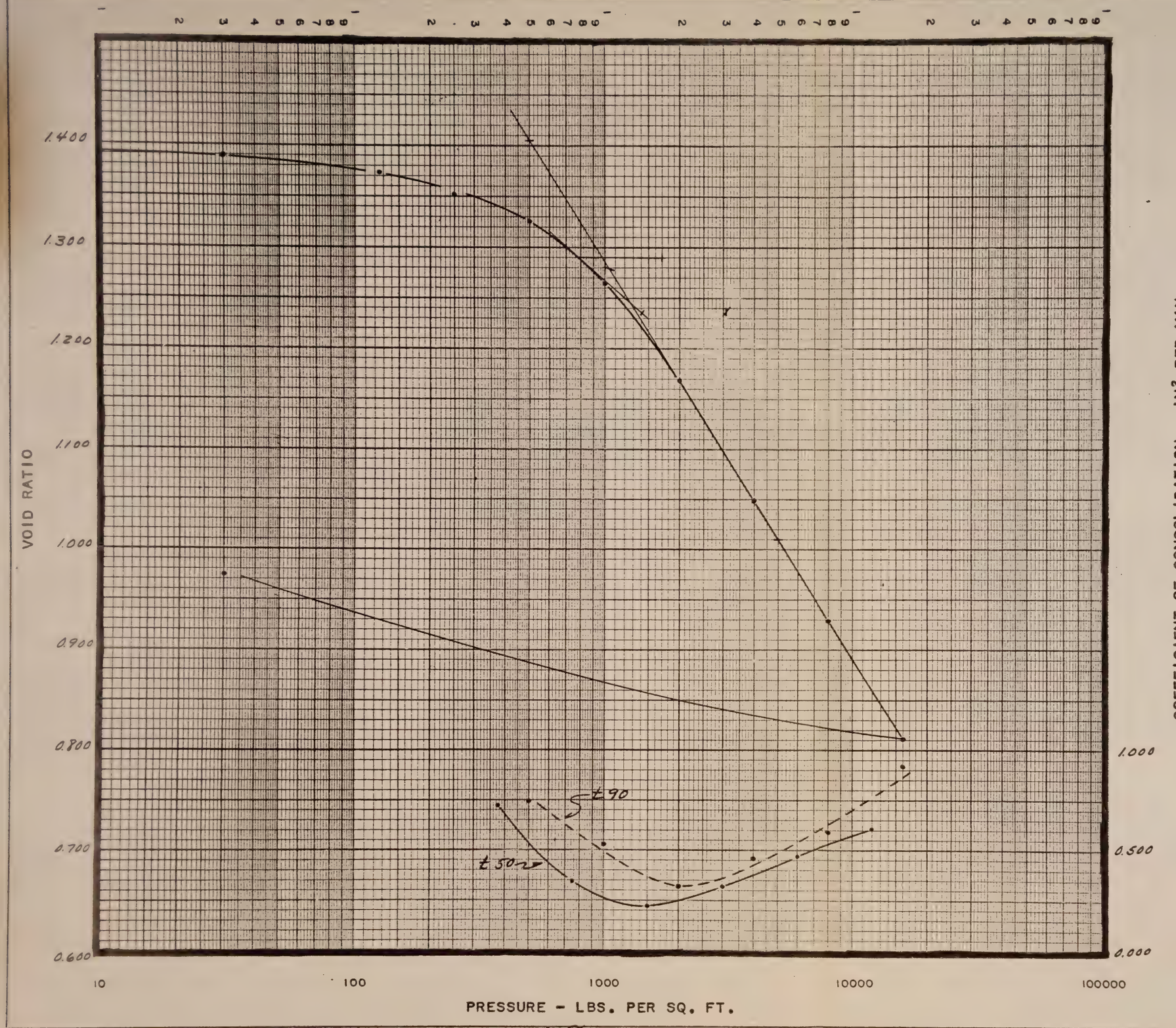
Additional computer programming might take the form of plotting the void ratio versus log of pressure and the location of the t_{50} and t_{90} points on the time-compression curve and the subsequent computing of the C_v values.

Conclusion Cont'd

These steps were omitted for the present due to the desirability of having a presentation or cover sheet consisting of the void ratio versus log of pressure plot accompanied by an overall summary.

In our opinion, including the calculation of coefficient of consolidation from a time compression curve would tend to eliminate the judgement and experience necessary to apply the fitting methods.

FORM SM 292 (6/64)



A 8

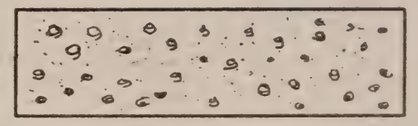
STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS
BUREAU OF SOIL MECHANICS

CONSOLIDATION TEST

PROJECT *UTICA-FRANKFORT - ILION*

HOLE NUMBER *UH-55* DEPTH *155'*
STATION *℄ 449+00* OFFSET *25' Rt*
LABORATORY NUMBER *2-368-UH55-T8*
DATA CODE *996* MACHINE NUMBER *23*

VISUAL DESCRIPTION
DARK GRAY SILT
some Organic
trace Marl & Clay
M-S-LR



SAMPLE PROFILE

TEST SET UP BY *R. Pyskodlo* DATE *3-18-64*

CLASSIFICATION TESTS

MOISTURE CONTENT	*51.2*	%
WET DENSITY	*107.2*	PCF
SPECIFIC GRAVITY	*2.72*	
LIQUID LIMIT	*42.9*	
PLASTIC LIMIT	*24.3*	
PLASTIC INDEX	*18.6*	
ORGANIC CONTENT	*2.49*	%

PERCENT FINER THAN
.074MM — .020MM — .002MM —

PRECONSOLIDATION PRESSURE
MINIMUM _____ MAXIMUM *1040*

COMPRESSION INDEX *0.395*

REMARKS:

DRAWN BY *G. Jillson* DATE *6-24-64*
CHECKED BY *W Reuer* DATE *6-24-64*

Consolidation Test

Program 5502

I. Description of Work Being Done by Computer

A) Described under General A and B.

II. Data Submitted to E.D.P.

A) Data will be batched and submitted weekly. Engineer-in-charge should check forms # SM290 and # SM291 for completion and accuracy before submission to EDP for production. Form EDP-3a must accompany test data when forwarded to the computer unit for processing. A sample transmittal form appears below.

orm EDP - 3a (7/63)

BUREAU OF EDP

JOB TRANSMITTAL CARD

Control Identification Number

bmitting Bureau or Unit PHYSICAL RESEARCH Location BLDG 8

ite of Submission 04|30|64 by HENRY RIVET Ext. 2345

ite of Completion 05|05|64 Actual Completion Date

b Title: CONSOLIDATION TEST Procedure No. 5502.02

marks:

☒ Recurring
☐ Special

☒ Key Punch ☐ Tabulate ☐ Reproduce ☐ Sort
☐ Printing Punch ☐ Interpret ☐ Collate ☒ Compute

r further detailed instructions, see reverse side.

III. Work Done by E.D.P. on Data

a) Cards punched

1) Part I

A. The first card contains laboratory number. Card two contains zero dial reading and number of tests made on sample. Card three lists test initializing data. Subsequent cards contain test data.

B. Cards are fed through IBM 1620 Computer where computations are accomplished according to program list.

2) Part II

A. The first card contains test code number and load. The five subsequent cards contain test data. Each column of data follows this order for every test.

B. Cards are fed through IBM 1620 Computer which causes on-line plotter to plot time-deflection curves.

b) All printed forms are separated and bursted.

IV. Data Returned to Bureau of Soils

a) Input data cards, forms and listings.
b) Output

1) Part I

A. Moisture Content, Height of Solid, Wet Density, Saturation, Void Ratio and Average Sample Height Squared.

2) Part II

A. Run #1
Plots of log (time) against dial deflection.

B. Run #2
Plots of square root of time against dial deflection.

Bureau of Soils - Consolidation Test

Program Number 5502-1

Symbol List

The following symbols are used in the test computations:

Symbol	Description
DEPTH	Depth
WTSG	Wt. of Glass + Wet Soil
WTGLS	Wt. of Glass
WDSTR	Wt. of Dry Soil and Tare
VFACT	Volume Factor
ARING	Area of Ring
HRING	Height of Ring
SGRAV	Specific Gravity
N	Number of Tests (Loads)
WTARE	Tare
ZDR	Dial Reading (Zero Load)
NLD	Load Number
XLOAD	Load
FDR	Final Dial Reading
WDRY	Wt. of Dry Soil
WWSL	Wt. of Wet Soil
WTDEN	Wet Density
WH2O	Wt. of Water
XCONT	Moisture Content
VSOL	Volume of Solids

Symbol	Description
HSOL	Height of Solids
SAT	Saturation
CONS	Consolidation
HSAMP	Height of Sample
HVOID	Height of Voids
VOIDR	Void Ratio
AHSQ	Average Height Squared
LABNO	Laboratory Number

All formulae used may be found in listing of source program.

Consolidation Test

Program Number 5502-1

FORMULAE

Weight of dry soil	=	WDSTR - WTARE
Weight of wet soil	=	WTSG - WTGLS
Wet density	=	(WWSL) - (VFACT)
Weight of water	=	WWSL - WDRY
Moisture Content	=	$\frac{WH2O}{WDRY}$ (100)
Volume of solids	=	$\frac{WDRY}{SGRAV}$
Height of solids	=	$\frac{VSOL}{A\ (ARING)}$, A = 16.3872
Saturation	=	$\frac{WH2O}{A\ (HRING - HSOL)\ \ (ARING)}$
Consolidation	=	ZDR - FDR
Height of sample	=	HRING - CONS
Height of voids	=	HSAMP - HSOL
Void ratio	=	$\frac{HVOID}{HSOL}$

Average height squared

This represents the average height of two consecutive loads on the sample, squared. In this problem, average height is halved because of the presence of a porous material placed above and below the test sample leaving it free to drain in both directions.

The formula thus becomes:

AHSQ = ((HSAMP + HSAM1)/2/2**2

SM-291 (6/64)

STATE OF NEW YORK DEPARTMENT OF PUBLIC WORKS BUREAU OF SOIL MECHANICS

CONSOLIDATION TEST – VOID RATIO COMPUTATIONS PROGRAM NO. 5502-1 I.B.M. 1620 COMPUTER

PROJECT UTICA-FRANKFORT-ILION

DATA BY G. Jillson DATE 6-2-64

CHECKED BY E. Dannehy DATE 6-3-64

LAB NO. 2-368-UHS5-T8

CODE NO. 996

CARD 1

LABORATORY NO.						
DIST. 29 NO.		PROJECT NO.		HOLE NO.		SAMPLE NO. 45
2	–	368	–	UHS5	–	T8

CARD 2

ZERO LOAD DIAL READING 1–5	NO. OF LOADS 6–7
48260	11

CARD 3

WEIGHTS

DEPTH 1–4	GLASS + WET SOIL 5–8	GLASS 9–12	TARE + DRY SOIL 13–16	TARE 17–20	VOLUME FACTOR 21–24	AREA OF RING 25–28	HEIGHT OF RING 29–33	SPECIFIC GRAVITY 34–36
155	2275	1227	1014	321	1023	5027	07397	272

CARD TYPE 4

LINE	LOAD NO. 1–2	LOAD 3–7	FINAL DIAL READING 8–12
1	1	0	48260
2	2	30	48180
3	3	125	47700
4	4	250	47020
5	5	500	46233
6	6	1000	44344
7	7	2000	41369
8	8	4000	37670
9	9	8000	33955
10	10	16000	30313

CARD TYPE 4 CONTINUED

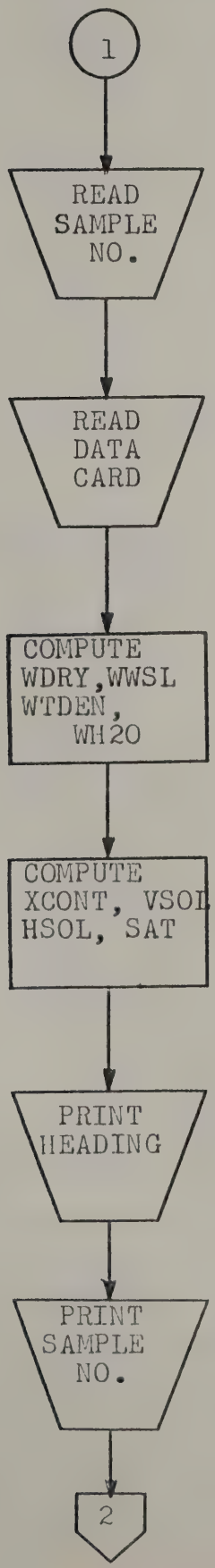
LINE	LOAD NO. 1–2	LOAD 3–7	FINAL DIAL READING 8–12
11	11	30	35332
12			
13			
14			
15			
16			
17			
18			
19			
20			

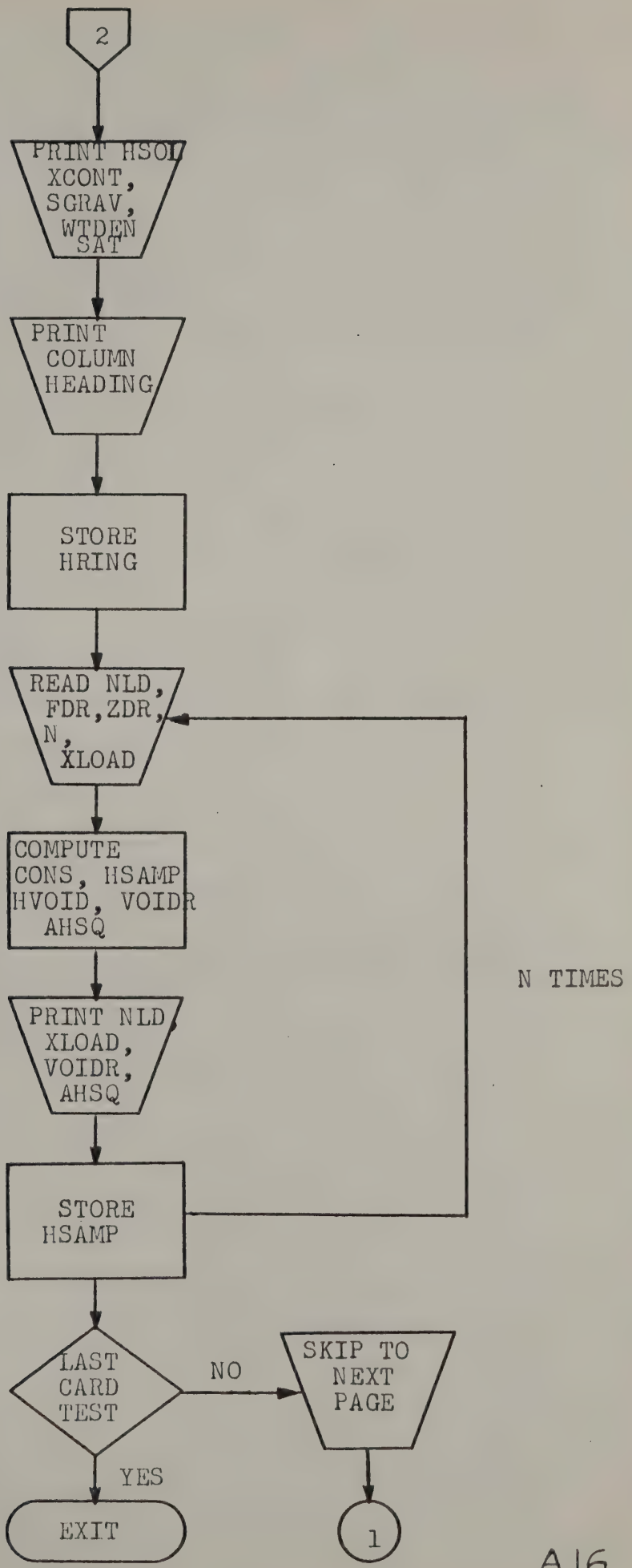
A14

Consolidation Test

Program Number 5502-1

Block Diagram




2
PRINT HSOL XCONT, SGRAV, WTDEN SAT
PRINT COLUMN HEADING
STORE HRING
READ NLD, FDR, ZDR, N, XLOAD
COMPUTE CONS, HSAMP HVOID, VOIDR AHSQ
PRINT NLD, XLOAD, VOIDR, AHSQ
STORE HSAMP
N TIMES
LAST CARD TEST
NO
SKIP TO NEXT PAGE
YES
EXIT
1

```
C      CONSOLIDATION TEST   PROGRAM NUMBER 5502   BY H. RIVET
   18 READ 3
      READ 15,ZDR,N
      READ 1,DEPTH,WTSG,WTGLS,WDSTR,WTARE,VFACT,ARING,HRING,SGRAV
      WDRY = WDSTR - WTARE
      WWSL = WTSG - WTGLS
      WTDEN = WWSL * VFACT
      WH2O = WWSL - WDRY
      XCONT = WH2O / WDRY * 100.
      VSOL = WDRY / SGRAV
      HSOL  = VSOL /(ARING * 16.3872)
      SAT = WH2O /((HRING - HSOL)* ARING*16.3872)*100.
      PRINT 2
      PRINT 3
      CONTROL 952
      PRINT 12, DEPTH, HSOL
      PRINT 4,XCONT,SGRAV
      PRINT 5,WTDEN,SAT
      PRINT 6
      PRINT 7
      HSAM1 = HRING
      DO 9 I = 1,N
      READ 13,NLD,XLOAD,FDR
      CONS=ZDR - FDR
      HSAMP = HRING - CONS
      HVOID = HSAMP - HSOL
      VOIDR = HVOID / HSOL
      AHSQ =((HSAMP + HSAM1)/2./2.)**2
      CONTROL 951
      PRINT 10,NLD,XLOAD,VOIDR,AHSQ
    9 HSAM1 = HSAMP
      IF(SENSE SWITCH 9)16,17
   17 CONTROL 971
      GO TO 18
    1 FORMAT(5F4.1,2F4.3,F5.4,F3.2)
    2 FORMAT (28X,18HCONSOLIDATION TEST,//)
    3 FORMAT(28X,19H LABNO              )
    4 FORMAT(9X,16HMOISTURE CONTENT,F7.2,7X,16HSPECIFIC GRAVITY,F6.2,//)
    5 FORMAT(9X,11HWET DENSITY,F12.2,7X,10HSATURATION,F12.2,//)
    6 FORMAT(46X,13HCV(IN SQ/MIN))
    7 FORMAT(14H    LOAD NO   ,7HLOAD   ,13HVOID RATIO   ,
     113HAV HT SQ     ,8HT50      ,9HT90       ,2HCS)
   10 FORMAT(I8,F10.0,F10.4,F13.4)
   12 FORMAT(9X,5HDEPTH,F18.1,7X,15HHEIGHT OF SOLID,F7.4,//)
   13 FORMAT(I2,F5.0,F5.5)
   15 FORMAT (F5.5, I2)
   16 STOP
      END
```

CONSOLIDATION TEST

2- 368- UHS5- T8

DEPTH 15.5 HEIGHT OF SOLID .3092

MOISTURE CONTENT 51.22 SPECIFIC GRAVITY 2.72

WET DENSITY 107.21 SATURATION 100.12

LOAD NO	LOAD	VOID RATIO	AV HT SQ	CV(IN SQ/MIN) T50	CV(IN SQ/MIN) T90	CS
1	.	1.3916	.1367			
2	30.	1.3891	.1366			
3	125.	1.3735	.1356			
4	250.	1.3515	.1334			
5	500.	1.3261	.1308	.0716	.0744	.0044
6	1000.	1.2650	.1260	.0345	.0529	.0111
7	2000.	1.1688	.1175	.0220	.0321	.0168
8	4000.	1.0492	.1063	.0317	.0460	.0176
9	8000.	.9291	.0946	.0466	.0594	.0156
10	16000.	.8114	.0836	.0610	.0921	.0129
11	30.	.9736	.0856			

Bureau of Soil Mechanics

Consolidation Test

Program Number 5502-2

SYMBOL LIST

Symbol	Description
ZLOAD	Load
R (I,1)	Time
R (I,2)	Dial Reading
IORG1	Time coordinate at origin
IORG2	Dial reading coordinate at origin
NN	Counter
MM	Counter
N	Plot counter
IXY (N)	Plot coordinates
DUM = PLT (I.J)	Plot Instructions
DUM = XNM (A)	Plotter print instructions

There were no formulae used in the plot portion of this program. However, it will be noted that rather than computing the value of log (time), a log table was incorporated in the program itself. The reason for this was for programming time considerations. Because of the nature of the plotter and time interval covered, it was deemed more economical to devise this table rather than to compute values.

Form SM-290 (6/64)

STATE OF NEW YORK DEPARTMENT OF PUBLIC WORKS — BUREAU OF SOIL MECHANICS

CONSOLIDATION TEST TIME COMPRESSION DATA — PROGRAM NO. 5502-2 — I.B.M. 1620 COMPUTER

DATA BY G. Illson — DATE 6-2-64

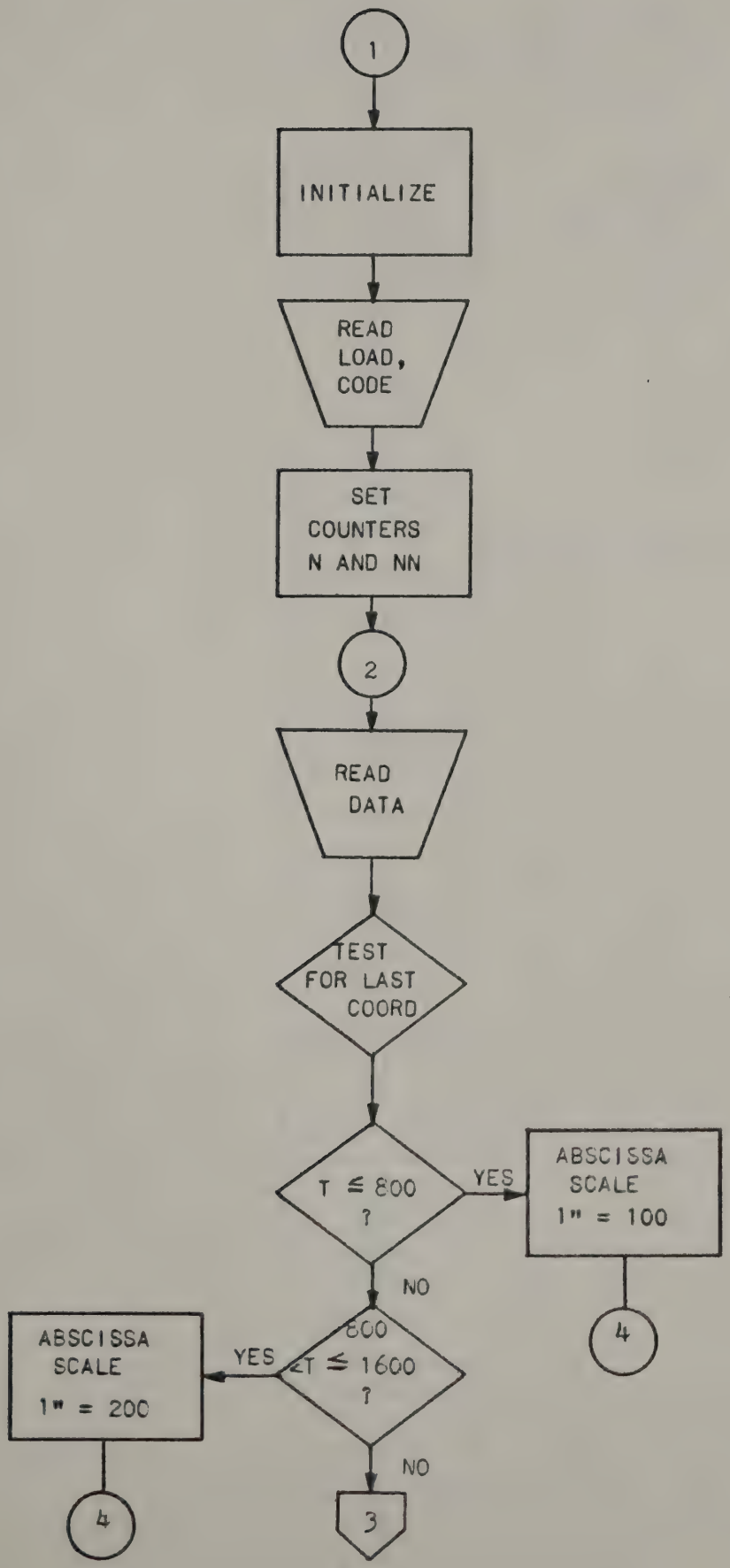
CHECKED BY E. Dannehy — DATE 6-3-64 — LABORATORY NO. 2-368-UHSS-T8

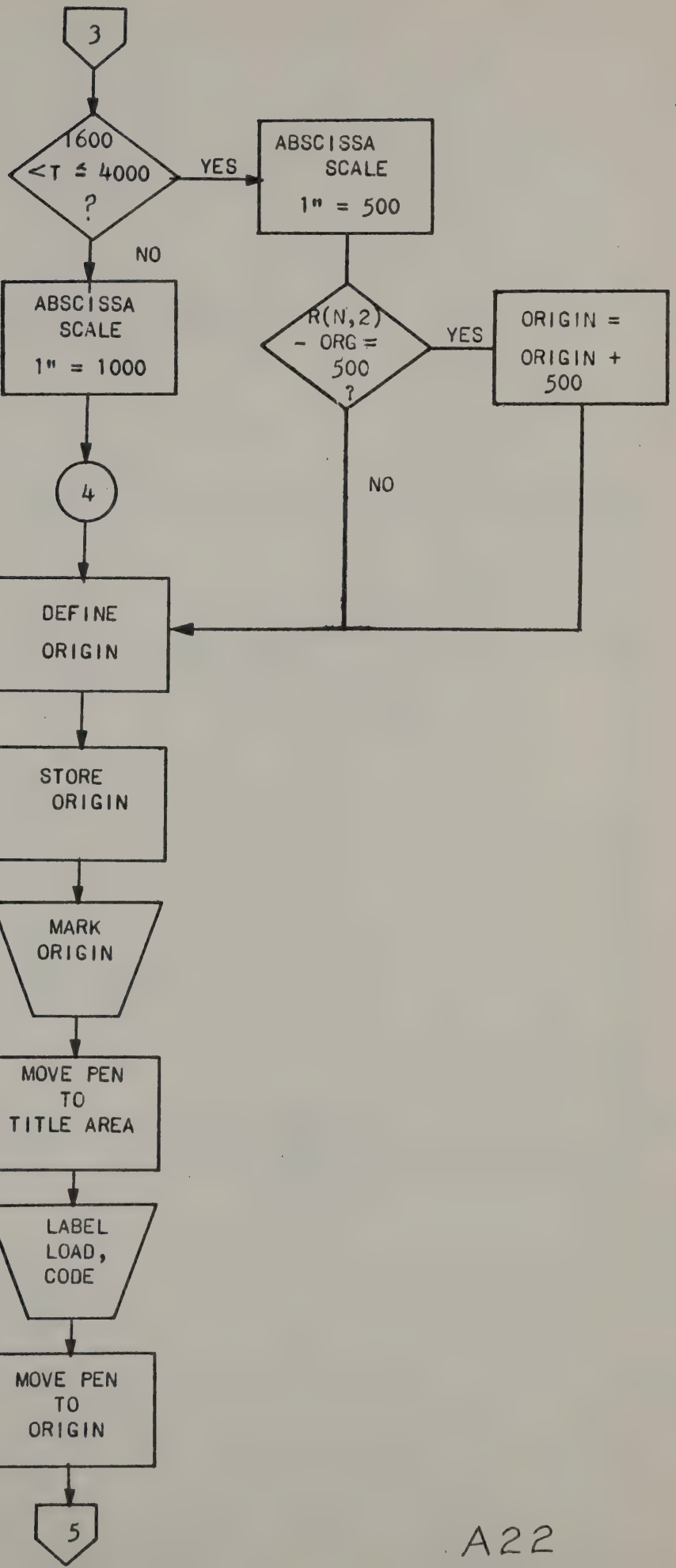
START 8:15			START 11:15			START 2:15			START 8:15		
1 CODE 5: 17916			18916			19916			11016		
6 LOAD 10: 12000			14000			18000			16000		
TIME	DIAL	STOPWATCH RDG.	TIME	DIAL	STOPWATCH RDG.	TIME	DIAL	STOPWATCH RDG.	TIME	DIAL	STOPWATCH RDG.
.00	44344	0	.00	41369	0	.00	37670	0	.00	33955	
.02		1"	.02		1"	.02		1"	.02		
.03		2"	.03		2"	.03		2"	.03		
.07		4"	.07		4"	.07		4"	.07		
.10		6"	.10		6"	.10		6"	.10		
.13		8"	.13		8"	.13		8"	.13		
.17		10"	.17		10"	.17		10"	.17		
.20		12"	.20		12"	.20		12"	.20		
.25	43922	15"	.25	40695	15"	.25	36730	15"	.25	32750	
.33		20"	.33		20"	.33		20"	.33		
.50	43713	30"	.50	40365	30"	.50	36313	30"	.50	32319	
.75	43560	45"	.75	40100	45"	.75	36040	45"	.75	32061	
1.00	43431	1'	1.00	39900	1'	1.00	35852	1'	1.00	31909	
1.25	43322	1¼'	1.25	39760	1¼'	1.25	35725	1¼'	1.25	31811	
1.50	43237	1½'	1.50	39649	1½'	1.50	35632	1½'	1.50	31749	
2.00	43107	2'	2.00	39461	2'	2.00	35497	2'	2.00	31629	
2.50	43002	2½'	2.50	39378	2½'	2.50	35382	2½'	2.50	31556	
3.00	42921	3'	3.00	39247	3'	3.00	35329	3'	3.00	31501	
4.00	42799	4'	4.00	39112	4'	4.00	35221	4'	4.00	31422	
5.00	42709	5'	5.00	39020	5'	5.00	35156	5'	5.00	31367	
6.00	42639	6'	6.00	38951	6'	6.00	35100	6'	6.00	31321	
8.00	42540	8'	8.00	38852	8'	8.00	35022	8'	8.00	31254	
10.00	42467	10'	10.00	38747	10'	10.00	34962	10'	10.00	31207	
12.00	42412	12'	12.00	38730	12'	12.00	34913	12'	12.00	31168	
15.00	42350	15'	15.00	38668	15'	15.00	34852	15'	15.00	31120	
20.00	42273	20'	20.00	38581	20'	20.00	34797	20'	20.00	31062	
25.00		25'	25.00	38535	25'	25.00	34745	25'	25.00	31020	
30.00	42173	30'	30.00	38490	30'	30.00	34705	30'	30.00	30982	
45.00	42078	45'	45.00	38397	45'	45.00	34619	45'	45.00	30903	
60.00	42002	1 hr.	60.00	38329	1 hr.	60.00	34561	1 hr.	60.00	30855	
75.00	41961	1¼ hr.	75.00	38281	1¼ hr.	75.00	34500	1¼ hr.	75.00		
90.00	41919	1½ hr.	90.00		1½ hr.	90.00	34479	1½ hr.	90.00	30785	
120.00	41857	2 hr.	120.00	38199	2 hr.	120.00	34429	2 hr.	120.00	30733	
150.00	41806	2½ hr.	150.00	38125	2½ hr.	150.00		2½ hr.	150.00	30698	
180.00	41767	3 hr.	180.00	38065	3 hr.	180.00		3 hr.	180.00	30665	

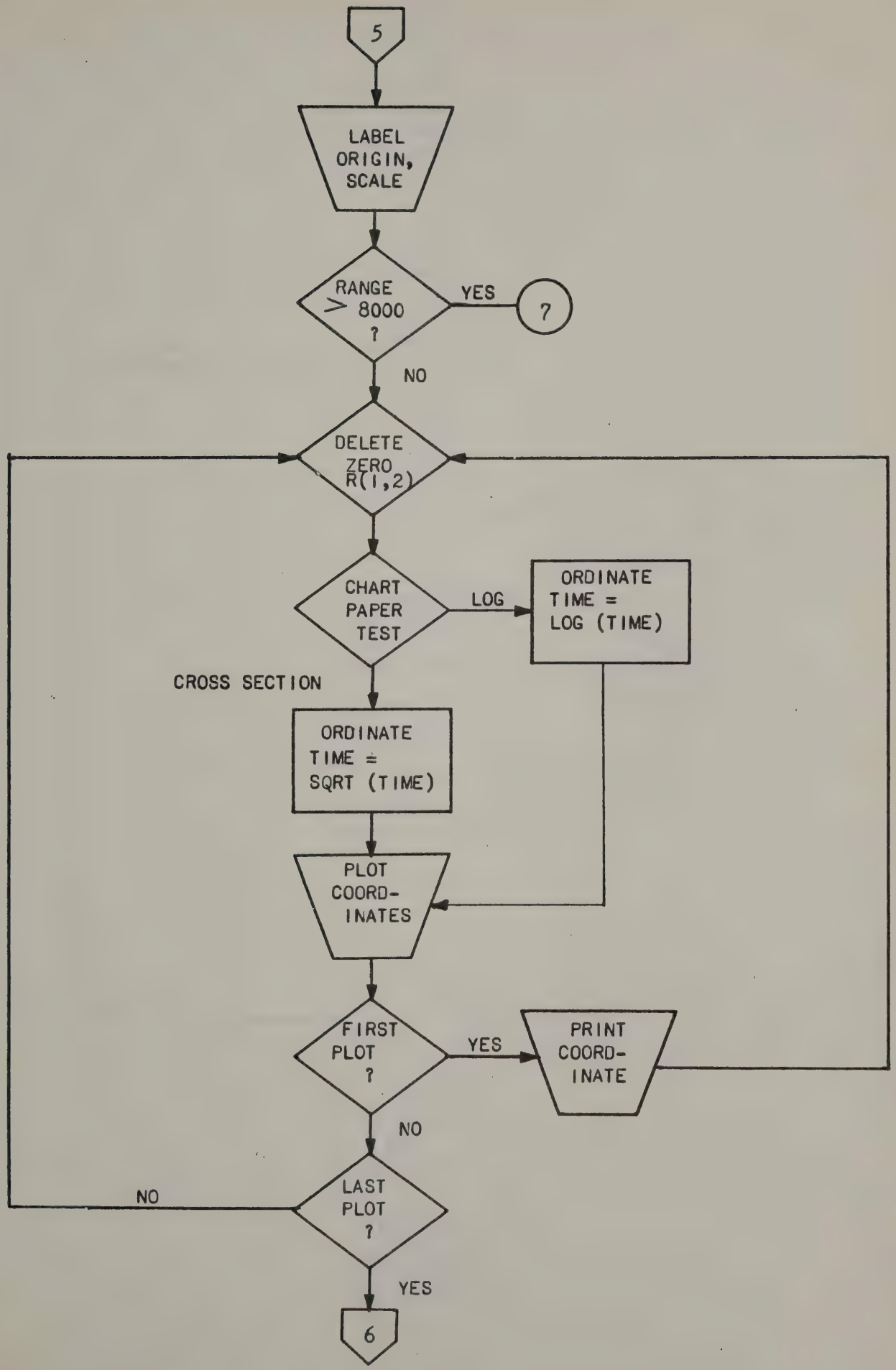
CONSOLIDATION TEST

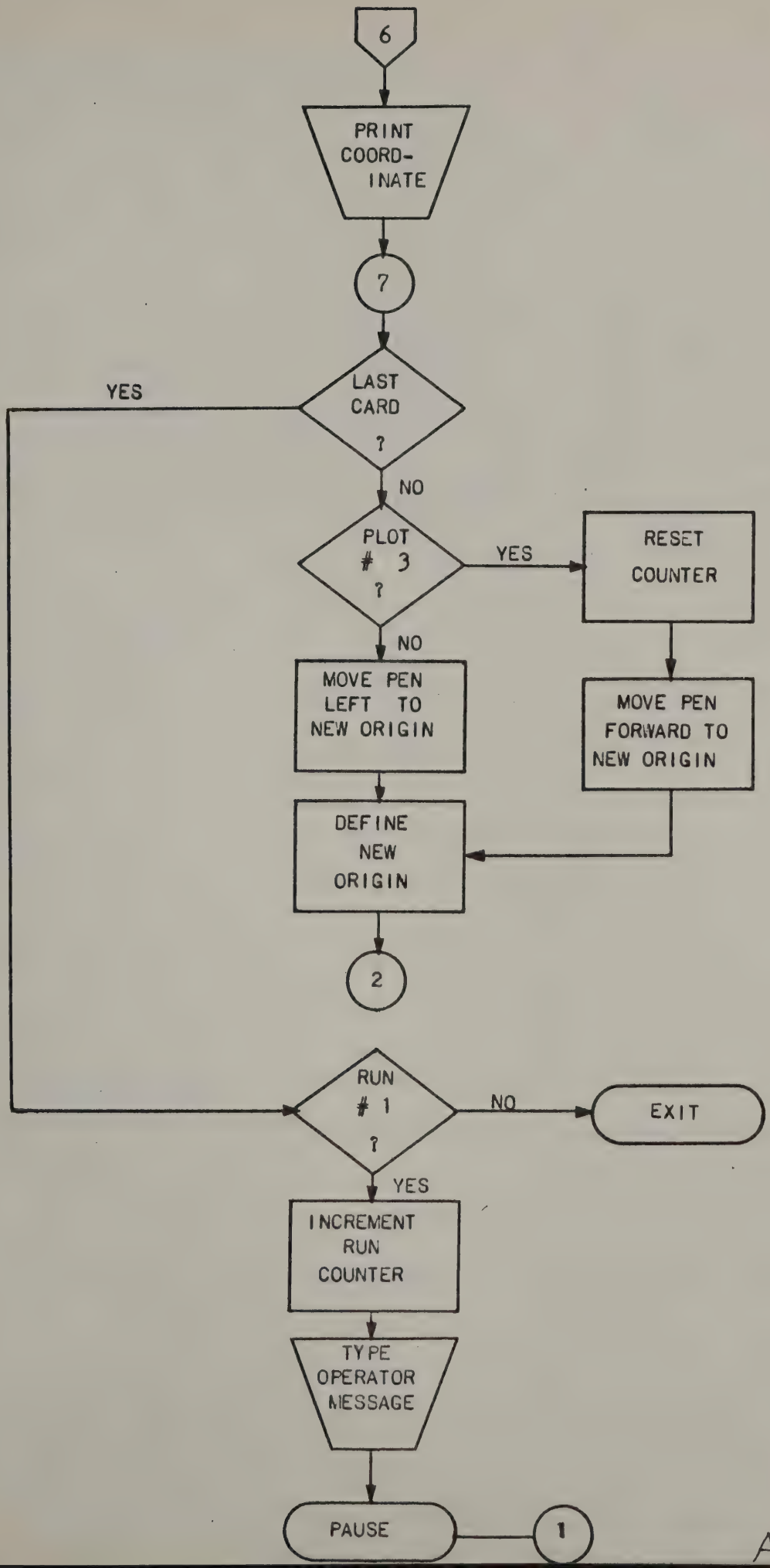
PROGRAM NUMBER 5502 - 2

BLOCK DIAGRAM




3
1600 <T ≤ 4000 ?
YES
ABSCISSA SCALE 1" = 500
NO
ABSCISSA SCALE 1" = 1000
R(N,2) - ORG = 500 ?
YES
ORIGIN = ORIGIN + 500
NO
4
DEFINE ORIGIN
STORE ORIGIN
MARK ORIGIN
MOVE PEN TO TITLE AREA
LABEL LOAD, CODE
MOVE PEN TO ORIGIN
5


5
LABEL ORIGIN, SCALE
RANGE > 8000 ?
YES
7
NO
DELETE ZERO R(I,2)
CHART PAPER TEST
LOG
ORDINATE TIME = LOG (TIME)
CROSS SECTION
ORDINATE TIME = SQRT (TIME)
PLOT COORD-INATES
FIRST PLOT ?
YES
PRINT COORD-INATE
NO
LAST PLOT ?
NO
YES
6

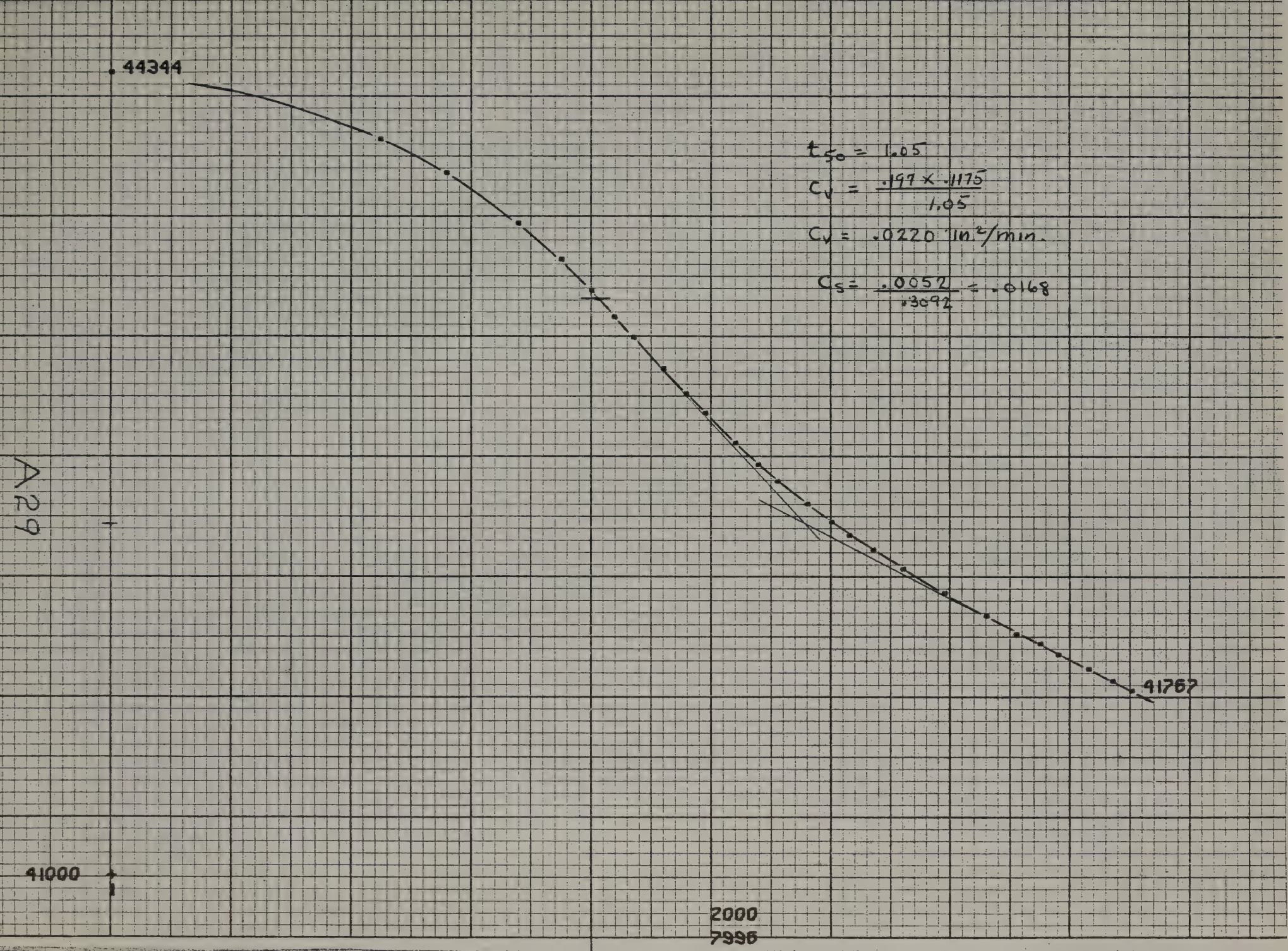

6
PRINT COORD- INATE
7
LAST CARD ?
YES
NO
PLOT # 3 ?
YES
RESET COUNTER
NO
MOVE PEN LEFT TO NEW ORIGIN
MOVE PEN FORWARD TO NEW ORIGIN
DEFINE NEW ORIGIN
2
RUN # 1 ?
NO
EXIT
YES
INCREMENT RUN COUNTER
TYPE OPERATOR MESSAGE
PAUSE
1

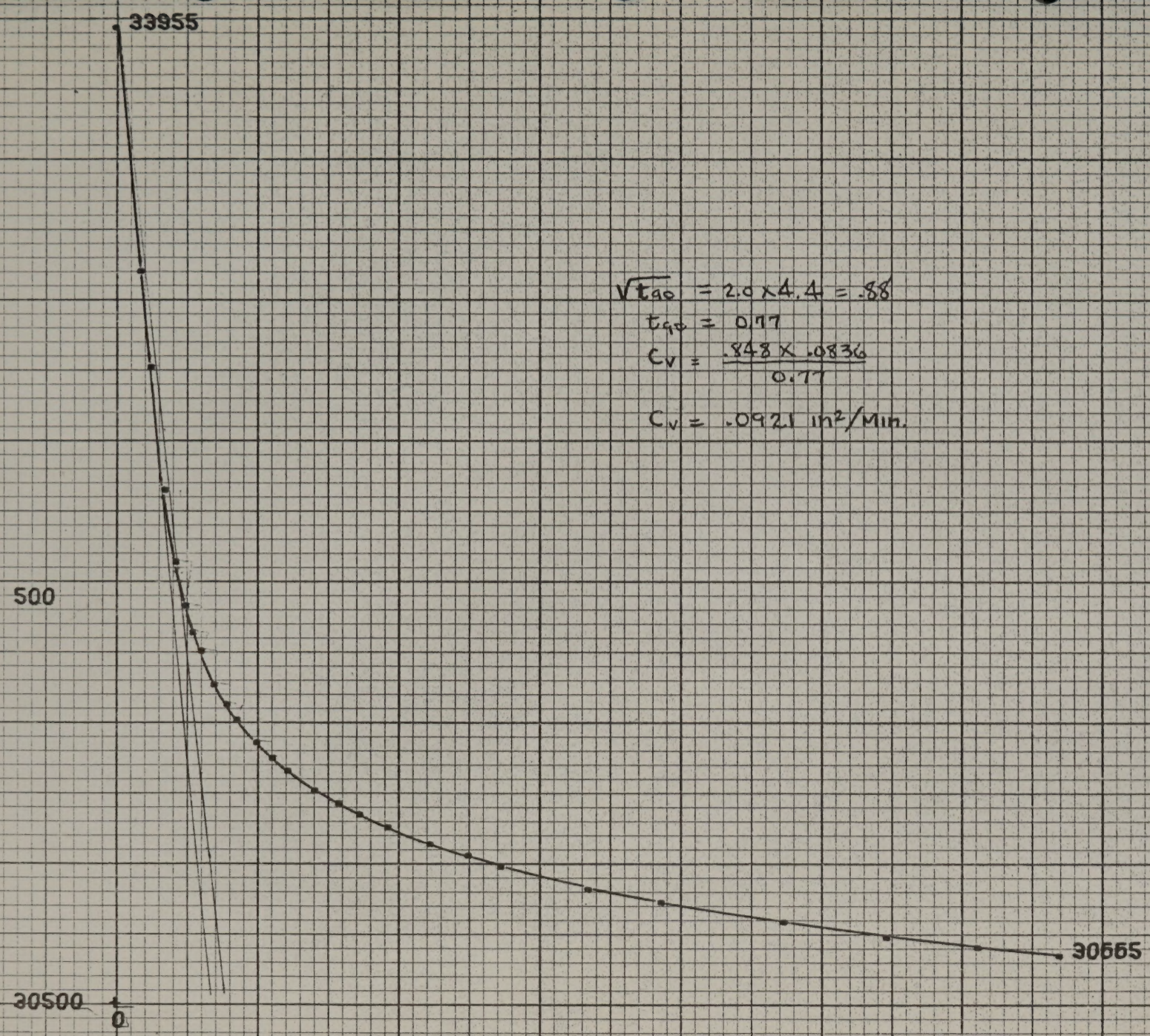
```
    CONSOLIDATION TEST PROGRAM NO. 5502 BY H. RIVET
    DIMENSION  IXY(4),R(35,2)
    IF(SENSE SWITCH 9)78,78
 78 XX=0.
    XY = 1.
    MM = 0
 49 NN=0
 40 READ 16, CODE, ZLOAD
    N=35
    NN=NN+1
    READ 18,R(1,1),R(1,2),R(2,1),R(2,2),R(3,1),R(3,2),R(4,1),R(4,2),
   1R(5,1),R(5,2),R(6,1),R(6,2),R(7,1),R(7,2)
    READ 18,R(8,1),R(8,2),R(9,1),R(9,2),R(10,1),R(10,2),R(11,1),
   1R(11,2),R(12,1),R(12,2),R(13,1), R(13,2),R(14,1),R(14,2)
    READ 18,R(15,1),R(15,2),R(16,1),R(16,2),R(17,1),R(17,2),R(18,1),
   1R(18,2),R(19,1),R(19,2),R(20,1),R(20,2),R(21,1),R(21,2)
    READ 18,R(22,1),R(22,2),R(23,1),R(23,2),R(24,1),R(24,2),R(25,1),
   1R(25,2),R(26,1),R(26,2),R(27,1),R(27,2),R(28,1),R(28,2)
    READ 18,R(29,1),R(29,2),R(30,1),R(30,2),R(31,1),R(31,2),R(32,1),
   1R(32,2),R(33,1),R(33,2),R(34,1),R(34,2),R(35,1),R(35,2)
 60 IF(R(N,2))62,61,62
 61 N=N-1
    GO TO 60
    ABSCISSA SCALE FOLLOWS                                    5502
 62 T = R(1,2) - R(N,2)
    IF(T-800.)31,31,34
 34 IF(T-1600.)32,32,35
 35 IF(T-4000.)33,33,36
 31 IX = R(N,2)/100.
    X = IX
    X = X * 100.
    SCALE = 1.
    GO TO 73
 32 IX = R(N,2)/100.
    X = IX
    X = X * 100.
    SCALE = 2.
    GO TO 73
 33 IX = R(N,2)/1000.
    X = IX
    X = X * 1000.
    SCALE = 5.
    YY = R(N,2) - X
    IF(YY - 500.)73,73,37
 37 X = X + 500.
    GO TO 73
 36 IX = R(N,2)/1000.
    X = IX
    X = X * 1000.
    SCALE = 10.
    DEFINE ORIGIN                                             5502
 73 IXY(1) = 0
    IXY(2) = -1
    IORG1 = IXY(1)
    IORG2 = IXY(2) + 1
    DUM = PLT(0.0)
    PRINT LOAD IN PSF
    IXY(1) = IXY(1)+500
    IXY(2) = IXY(2)-30
```

```
      DUM = PLT(1.1)
      DUM = XNM(ZLOAD)
      IXY(2) = IXY(2) - 20
      DUM = PLT(1.1)
      DUM = XNM(CODE)
      IXY(1) = IORG1
      IXY(2) = IORG2
      DUM = PLT(1.1)
      IXY(1) = IXY(1)+3
      IXY(2) = IXY(2) + 1
      IXY(3)=IXY(1)-6
      IXY(4)=IXY(2)
      DUM=PLT(1.0)
      IXY(2)=IXY(2)+3
      IXY(4)=IXY(2)-6
      IXY(1) = IXY(1)-3
      IXY(3)=IXY(1)
      DUM = PLT(1.0)
      IXY(1) = IXY(1) - 60
      IXY(2) = IXY(2) -9
      DUM = PLT(1.1)
      DUM = XNM(X)
      IXY(1) = IXY(1)+56
      IXY(2) = IXY(2)-11
      DUM = PLT(1.1)
      IF(MM)89,88,89
   88 DUM = XNM(XY)
      GO TO 108
   89 DUM = XNM(XX)
  108 IXY(1) = IXY(1) - 26
      IXY(2) = IXY(2) + 300
      DUM = PLT(1.1)
      DUM = XNM(SCALE*100.)
      TT = R(1,2) - X
      IF(TT - 9470.)109,109,90
  109 DO 20 I = 1,N
      IF(R(I,2))19,20,19
      TEST FOR GRAPH PAPER   0= LOG, 1= CROSS SECTION
   19 IF(MM)42,41,42
      TEST FOR SCALE                                          5502
   41 R(1,1) = 0.
      R(2,1) = 0.2210
      R(3,1) = 0.5224
      R(4,1) = 0.8235
      R(5,1) = 1.0000
      R(6,1) = 1.1239
      R(7,1) = 1.2201
      R(8,1) = 1.3010
      R(9,1) = 1.3979
      R(10,1) =1.5224
      R(11,1) =1.6990
      R(12,1) =1.8751
      R(13,1) =2.0000
      R(14,1) =2.0969
      R(15,1) =2.1761
      R(16,1) =2.3010
      R(17,1) =2.3979
      R(18,1) =2.4771
      R(19,1) =2.6021
```

```
      R(20,1) =2.6990
      R(21,1) =2.7782
      R(22,1) =2.9031
      R(23,1) =3.0000
      R(24,1) =3.0792
      R(25,1) =3.1761
      R(26,1) =3.3010
      R(27,1) =3.3979
      R(28,1) =3.4771
      R(29,1) =3.6532
      R(30,1) =3.7782
      R(31,1) =3.8751
      R(32,1) =3.9542
      R(33,1) =4.0792
      R(34,1) =4.1761
      R(35,1) =4.2553
      IXY(1) = R(I,1)*200.-1.
      GO TO 30
      ORDINATE - LOG(TIME) = 2.0,  SQRT(TIME) = .50
   42 IXY(1) = SQRTF(R(I,1))* 50.-1.
      MARK PLOTS R(1,1) - R(35,1)
   30 IXY(3) = IXY(1)+2
      IXY(2) = (R(I,2) - X)/SCALE -1.
      IXY(4) = IXY(2)+2
      DUM = PLT(1.0)
      IXY(1) = IXY(3)
      IXY(4) = IXY(2)+2
      IXY(3) = IXY(1)-2
      DUM = PLT(1.0)
      TEST FOR FIRST AND LAST PLOT                                  5502
      IF(R(I,2) - R(1,2))20,22,20
   22 IXY(1) = IXY(1)+10
      PRINT FIRST AND LAST PLOT
      DUM = PLT(1.1)
      DUM = XNM(R(1,2))
   20 CONTINUE
      IXY(1) = IXY(1) + 10
      DUM = PLT(1.1)
      DUM = XNM(R(N,2))
      LAST CARD TEST                                                5502
   90 IF(SENSE SWITCH 9)45,70
   70 IF(NN-3)51,53,51
   51 IXY(2) = IORG2 + 950
      IXY(1)=IORG1
      GO TO 50
   53 IXY(1) = IORG1 + 1100
      IXY(2) = IORG2 - 1900
      NN = 0
   50 DUM = PLT(1.1)
      GO TO 40
   45 IF(MM)47,46,47
   46 MM = 1
      TYPE 48
      TYPE 68
      TYPE 39
      PAUSE
      GO TO 49
   47 TYPE 69
   16 FORMAT(2F5.0)
```

```
 18 FORMAT(F5.2,F5.0,F5.2,F5.0,F5.2,F5.0,F5.2,F5.0,F5.2,F5.0,
   1F5.2,F5.0,F5.2,F5.0)
 39 FORMAT(11HRELOAD DATA)
 48 FORMAT(//,29HCHANGE TO CROSS SECTION PAPER,//)
 68 FORMAT(17HSET PEN AT ORIGIN,//)
 69 FORMAT(16H// END OF JOB //)
200 FORMAT(2A5)
    END
```


44344
$t_{50} = 1.05$
$C_v = \frac{.197 \times .1175}{1.05}$
$C_v = .0220 \text{ in}^2/\text{min}.$
$C_s = \frac{.0052}{.3092} = .0168$
41767
A29
41000
2000
7996



$\sqrt{t_{90}} = 2.0 \times 4.4 = .88$

$t_{90} = 0.77$

$C_v = \frac{.848 \times .0836}{0.77}$

$C_v = .0921 \text{ in}^2/\text{Min.}$

01445
LRI